

Richard Hatton Associates		Page 1								
3 Drapers Way Stevenage Herts SG1 3DT										
Date 26/10/2017 13:40 File colin fix.mdx	Designed by colin Checked by									
XP Solutions	Network 2014.1									
Time Area Diagram for Storm 1 <table><thead><tr><th>Time (mins)</th><th>Area (ha)</th><th>Time (mins)</th><th>Area (ha)</th></tr></thead><tbody><tr><td>0-4</td><td>0.001</td><td>4-8</td><td>0.001</td></tr></tbody></table> Total Area Contributing (ha) = 0.002 Total Pipe Volume (m³) = 2.811			Time (mins)	Area (ha)	Time (mins)	Area (ha)	0-4	0.001	4-8	0.001
Time (mins)	Area (ha)	Time (mins)	Area (ha)							
0-4	0.001	4-8	0.001							
©1982-2014 XP Solutions										

Richard Hatton Associates		Page 2
3 Drapers Way Stevenage Herts SG1 3DT		
Date 26/10/2017 13:40 File colin fix.mdx	Designed by colin Checked by	
XP Solutions		Network 2014.1

Existing Network Details for Storm 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
15.000	1.433	0.018	79.6	0.000	5.00	0.0	0.600	o	150
16.000	7.268	0.073	100.0	0.000	5.00	0.0	0.600	o	100
17.000	8.718	0.087	100.0	0.000	5.00	0.0	0.600	o	100
16.001	9.759	-0.400	-24.4	0.000	0.00	0.0	0.600	o	100
16.002	4.773	0.269	17.7	0.000	0.00	0.0	0.600	o	100
16.003	11.403	0.287	39.7	0.000	0.00	0.0	0.600	o	100
16.004	6.454	0.288	22.4	0.000	0.00	0.0	0.600	o	100
15.001	2.224	0.028	79.4	0.000	0.00	0.0	0.600	o	150
18.000	8.599	1.160	7.4	0.000	5.00	0.0	0.600	o	100
18.001	3.652	0.037	100.0	0.000	0.00	0.0	0.600	o	150
19.000	6.241	0.051	123.3	0.002	5.00	0.0	0.600	o	100
19.001	6.027	0.008	753.4	0.000	0.00	0.0	0.600	o	100
19.002	8.275	-0.300	-27.6	0.000	5.00	0.0	0.600	o	100
18.002	15.407	-2.470	-6.2	0.000	0.00	0.0	0.600	o	75
18.003	9.896	0.329	30.1	0.000	0.00	0.0	0.600	o	225

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
15.000	94.957	0.000	0.0	1.13	19.9
16.000	95.700	0.000	0.0	0.77	6.0
17.000	95.840	0.000	0.0	0.77	6.0
16.001	95.600	0.000	0.0	0.00	0.0
16.002	95.783	0.000	0.0	1.84	14.5
16.003	95.514	0.000	0.0	1.23	9.6
16.004	95.227	0.000	0.0	1.64	12.9
15.001	94.939	0.000	0.0	1.13	20.0
18.000	93.737	0.000	0.0	2.86	22.4
18.001	92.577	0.000	0.0	1.00	17.8
19.000	93.155	0.002	0.0	0.69	5.4
19.001	93.104	0.002	0.0	0.27	2.1
19.002	93.100	0.002	0.0	0.00	0.0
18.002	92.540	0.002	0.0	0.00	0.0
18.003	95.010	0.002	0.0	2.39	95.2

Richard Hatton Associates		Page 3
3 Drapers Way Stevenage Herts SG1 3DT		
Date 26/10/2017 13:40 File colin fix.mdx	Designed by colin Checked by	
XP Solutions		Network 2014.1

Existing Network Details for Storm 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
15.002	14.514	0.181	80.2	0.000	0.00	0.0	0.600	o	225
20.000	10.633	-0.400	-26.6	0.000	5.00	0.0	0.600	o	100
20.001	8.533	1.060	8.0	0.000	5.00	0.0	0.600	o	100
15.003	4.951	0.050	99.0	0.000	0.00	0.0	0.600	o	225
15.004	4.951	0.050	99.0	0.000	0.00	0.0	0.600	o	225
15.005	10.106	0.101	100.1	0.000	0.00	0.0	0.600	o	150
15.006	14.862	-2.027	-7.3	0.000	0.00	0.0	0.600	o	75
15.007	6.184	0.060	103.1	0.000	0.00	0.0	0.600	o	225

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
15.002	94.681	0.002	0.0	1.46	58.1
20.000	95.900	0.000	0.0	0.00	0.0
20.001	96.500	0.000	0.0	2.74	21.5
15.003	94.500	0.002	0.0	1.31	52.2
15.004	94.450	0.002	0.0	1.31	52.2
15.005	94.400	0.002	0.0	1.00	17.8
15.006	94.443	0.002	0.0	0.00	0.0
15.007	96.470	0.002	0.0	1.29	51.2

Richard Hatton Associates		Page 4
3 Drapers Way Stevenage Herts SG1 3DT		
Date 26/10/2017 13:40 File colin fix.mdx	Designed by colin Checked by	
XP Solutions	Network 2014.1	

PIPELINE SCHEDULES for Storm 1

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
15.000	o	150	29	96.500	94.957	1.393	Open Manhole	450
16.000	o	100	54	96.300	95.700	0.500	Open Manhole	600
17.000	o	100	23	96.440	95.840	0.500	Open Manhole	600
16.001	o	100	24	96.200	95.600	0.500	Open Manhole	1200
16.002	o	100	38	96.470	95.783	0.587	Open Manhole	450
16.003	o	100	39	96.450	95.514	0.836	Junction	
16.004	o	100	33	96.450	95.227	1.123	Junction	
15.001	o	150	49	95.281	94.939	0.192	Junction	
18.000	o	100	16	94.120	93.737	0.283	Open Manhole	450
18.001	o	150	4	93.970	92.577	1.243	Open Manhole	450
19.000	o	100	11	93.800	93.155	0.545	Junction	
19.001	o	100	8	94.000	93.104	0.796	Open Manhole	450
19.002	o	100	51	93.696	93.100	0.496	Open Manhole	600
18.002	o	75	5	93.930	92.540	1.315	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
15.000	1.433	79.6	49	95.281	94.939	0.192	Junction	
16.000	7.268	100.0	24	96.200	95.627	0.473	Open Manhole	1200
17.000	8.718	100.0	24	96.200	95.753	0.347	Open Manhole	1200
16.001	9.759	-24.4	38	96.470	96.000	0.370	Open Manhole	450
16.002	4.773	17.7	39	96.450	95.514	0.836	Junction	
16.003	11.403	39.7	33	96.450	95.227	1.123	Junction	
16.004	6.454	22.4	49	95.281	94.939	0.242	Junction	
15.001	2.224	79.4	7	96.500	94.911	1.439	Open Manhole	1050
18.000	8.599	7.4	4	93.970	92.577	1.293	Open Manhole	450
18.001	3.652	100.0	5	93.930	92.540	1.240	Open Manhole	1200
19.000	6.241	123.3	8	94.000	93.104	0.796	Open Manhole	450
19.001	6.027	753.4	51	93.696	93.096	0.500	Open Manhole	600
19.002	8.275	-27.6	5	93.930	93.400	0.430	Open Manhole	1200
18.002	15.407	-6.2	6	96.000	95.010	0.915	Open Manhole	1200

Richard Hatton Associates		Page 5
3 Drapers Way Stevenage Herts SG1 3DT		
Date 26/10/2017 13:40 File colin fix.mdx	Designed by colin Checked by	
XP Solutions	Network 2014.1	

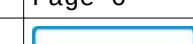
PIPELINE SCHEDULES for Storm 1

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
18.003	o	225	6	96.000	95.010	0.765	Open Manhole	1200
15.002	o	225	7	96.500	94.681	1.594	Open Manhole	1050
20.000	o	100	19	96.500	95.900	0.500	Open Manhole	1200
20.001	o	100	19	97.100	96.500	0.500	Open Manhole	1200
15.003	o	225	8	96.040	94.500	1.315	Open Manhole	1200
15.004	o	225	39	95.250	94.450	0.575	Open Manhole	1050
15.005	o	150	9	96.210	94.400	1.660	Open Manhole	1200
15.006	o	75	10	96.817	94.443	2.299	Open Manhole	1200
15.007	o	225	12	97.020	96.470	0.325	Open Manhole	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
18.003	9.896	30.1	7	96.500	94.681	1.594	Open Manhole	1050
15.002	14.514	80.2	8	96.040	94.500	1.315	Open Manhole	1200
20.000	10.633	-26.6	19	97.100	96.300	0.700	Open Manhole	1200
20.001	8.533	8.0	8	96.040	95.440	0.500	Open Manhole	1200
15.003	4.951	99.0	39	95.250	94.450	0.575	Open Manhole	1050
15.004	4.951	99.0	9	96.210	94.400	1.585	Open Manhole	1200
15.005	10.106	100.1	10	96.817	94.299	2.368	Open Manhole	1200
15.006	14.862	-7.3	12	97.020	96.470	0.475	Open Manhole	1050
15.007	6.184	103.1	EXTG	97.230	96.410	0.595	Open Manhole	600

Richard Hatton Associates		Page 6
3 Drapers Way Stevenage Herts SG1 3DT		
Date 26/10/2017 13:40 File colin fix.mdx	Designed by colin Checked by	
XP Solutions	Network 2014.1	

Area Summary for Storm 1

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
15.000	-	-	100	0.000	0.000	0.000
16.000	-	-	100	0.000	0.000	0.000
17.000	-	-	100	0.000	0.000	0.000
16.001	-	-	100	0.000	0.000	0.000
16.002	-	-	100	0.000	0.000	0.000
16.003	-	-	100	0.000	0.000	0.000
16.004	-	-	100	0.000	0.000	0.000
15.001	-	-	100	0.000	0.000	0.000
18.000	-	-	100	0.000	0.000	0.000
18.001	-	-	100	0.000	0.000	0.000
19.000	User	-	100	0.002	0.002	0.002
19.001	-	-	100	0.000	0.000	0.000
19.002	-	-	100	0.000	0.000	0.000
18.002	-	-	100	0.000	0.000	0.000
18.003	-	-	100	0.000	0.000	0.000
15.002	-	-	100	0.000	0.000	0.000
20.000	-	-	100	0.000	0.000	0.000
20.001	-	-	100	0.000	0.000	0.000
15.003	-	-	100	0.000	0.000	0.000
15.004	-	-	100	0.000	0.000	0.000
15.005	-	-	100	0.000	0.000	0.000
15.006	-	-	100	0.000	0.000	0.000
15.007	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.002	0.002	0.002

Free Flowing Outfall Details for Storm 1

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
15.007	EXTG	97.230	96.410	0.820	600	0

Simulation Criteria for Storm 1

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	8
Number of Online Controls	3	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Richard Hatton Associates		Page 7
3 Drapers Way Stevenage Herts SG1 3DT		
Date 26/10/2017 13:40 File colin fix.mdx	Designed by colin Checked by	
XP Solutions	Network 2014.1	

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.200	Storm Duration (mins)	30
Ratio R	0.413		

Richard Hatton Associates		Page 8
3 Drapers Way Stevenage Herts SG1 3DT		
Date 26/10/2017 13:40 File colin fix.mdx	Designed by colin Checked by	
XP Solutions	Network 2014.1	

Online Controls for Storm 1

Pump Manhole: 5, DS/PN: 18.002, Volume (m³): 1.7

Invert Level (m) 92.540

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.200	800.0000	0.600	1600.0000	1.000	1600.0000	1.400	1600.0000
0.400	800.0000	0.800	1600.0000	1.200	1600.0000	1.600	1600.0000

Pump Manhole: 10, DS/PN: 15.006, Volume (m³): 2.8

Invert Level (m) 94.443

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.200	5.0000	0.600	5.0000	1.000	5.0000	1.400	5.0000
0.400	5.0000	0.800	5.0000	1.200	5.0000	1.600	5.0000

Hydro-Brake Optimum® Manhole: 12, DS/PN: 15.007, Volume (m³): 0.5

Unit Reference MD-SHE-0114-5000-0400-5000
Design Head (m) 0.400
Design Flow (l/s) 5.0
Flush-Flo™ Calculated
Objective Minimise upstream storage
Diameter (mm) 114
Invert Level (m) 96.470
Minimum Outlet Pipe Diameter (mm) 150
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.400	5.0
Flush-Flo™	0.169	5.0
Kick-Flo®	0.312	4.5
Mean Flow over Head Range	-	4.0

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.0	1.000	7.7	2.400	11.6	5.500	17.3
0.200	5.0	1.200	8.3	2.600	12.0	6.000	18.0
0.300	4.6	1.400	9.0	3.000	12.9	6.500	18.8
0.400	5.0	1.600	9.6	3.500	13.9	7.000	19.5
0.500	5.5	1.800	10.1	4.000	14.8	7.500	20.2
0.600	6.0	2.000	10.6	4.500	15.6	8.000	20.9
0.800	6.9	2.200	11.1	5.000	16.4	8.500	21.5

Richard Hatton Associates		Page 9					
3 Drapers Way Stevenage Herts SG1 3DT							
Date 26/10/2017 13:40 File colin fix.mdx	Designed by colin Checked by						
XP Solutions Network 2014.1							
<u>Hydro-Brake Optimum® Manhole: 12, DS/PN: 15.007, Volume (m³): 0.5</u>							
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
9.000	22.1	9.500	22.7				

Richard Hatton Associates		Page 10
3 Drapers Way Stevenage Herts SG1 3DT		
Date 26/10/2017 13:40 File colin fix.mdx	Designed by colin Checked by	
XP Solutions	Network 2014.1	

Storage Structures for Storm 1

Porous Car Park Manhole: 54, DS/PN: 16.000

Infiltration Coefficient Base (m/hr)	0.00005	Width (m)	9.5
Membrane Percolation (mm/hr)	3386	Length (m)	17.0
Max Percolation (l/s)	151.9	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	0
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	95.840	Cap Volume Depth (m)	0.000

Porous Car Park Manhole: 23, DS/PN: 17.000

Infiltration Coefficient Base (m/hr)	0.00005	Width (m)	7.0
Membrane Percolation (mm/hr)	3386	Length (m)	13.0
Max Percolation (l/s)	85.6	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	0
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	95.700	Cap Volume Depth (m)	0.000

Porous Car Park Manhole: 16, DS/PN: 18.000

Infiltration Coefficient Base (m/hr)	0.00005	Width (m)	11.0
Membrane Percolation (mm/hr)	3386	Length (m)	33.0
Max Percolation (l/s)	341.4	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	0
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	93.520	Cap Volume Depth (m)	0.000

Porous Car Park Manhole: 5, DS/PN: 18.002

Infiltration Coefficient Base (m/hr)	0.00005	Width (m)	11.0
Membrane Percolation (mm/hr)	3386	Length (m)	33.0
Max Percolation (l/s)	341.4	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	0
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	93.330	Cap Volume Depth (m)	0.000

Porous Car Park Manhole: 19, DS/PN: 20.000

Infiltration Coefficient Base (m/hr)	0.00005	Width (m)	11.5
Membrane Percolation (mm/hr)	3386	Length (m)	28.0
Max Percolation (l/s)	302.9	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	0
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	95.900	Cap Volume Depth (m)	0.000

Porous Car Park Manhole: 19, DS/PN: 20.001

Infiltration Coefficient Base (m/hr)	0.00005	Max Percolation (l/s)	302.9
Membrane Percolation (mm/hr)	3386	Safety Factor	2.0

Richard Hatton Associates				Page 12																															
3 Drapers Way Stevenage Herts SG1 3DT																																			
Date 26/10/2017 13:40 File colin fix.mdx		Designed by colin Checked by																																	
XP Solutions		Network 2014.1																																	
Areas for Storm 1 <table><thead><tr><th>PN</th><th>C. Area (ha)</th><th>PIMP (%)</th><th>Imp. Area (ha)</th><th>X (m)</th><th>Y (m)</th></tr></thead><tbody><tr><td>19.000</td><td>0.002</td><td>100</td><td>0.002</td><td>611.109</td><td>708.374</td></tr><tr><td></td><td></td><td></td><td></td><td>602.660</td><td>699.503</td></tr><tr><td></td><td></td><td></td><td></td><td>604.315</td><td>698.341</td></tr><tr><td></td><td></td><td></td><td></td><td>611.989</td><td>707.776</td></tr></tbody></table>						PN	C. Area (ha)	PIMP (%)	Imp. Area (ha)	X (m)	Y (m)	19.000	0.002	100	0.002	611.109	708.374					602.660	699.503					604.315	698.341					611.989	707.776
PN	C. Area (ha)	PIMP (%)	Imp. Area (ha)	X (m)	Y (m)																														
19.000	0.002	100	0.002	611.109	708.374																														
				602.660	699.503																														
				604.315	698.341																														
				611.989	707.776																														
©1982-2014 XP Solutions																																			

Richard Hatton Associates		Page 13
3 Drapers Way Stevenage Herts SG1 3DT		
Date 26/10/2017 13:40 File colin fix.mdx	Designed by colin Checked by	
XP Solutions	Network 2014.1	

Rainfall Hyetograph for 15 minute 1 year Summer I+20% (Storm 1)

Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)
1	12.779	4	19.217	7	86.475	10	43.693	13	16.008
2	14.052	5	25.502	8	134.212	11	25.502	14	14.052
3	16.007	6	43.693	9	86.475	12	19.217	15	12.779